Voyager Bulletin

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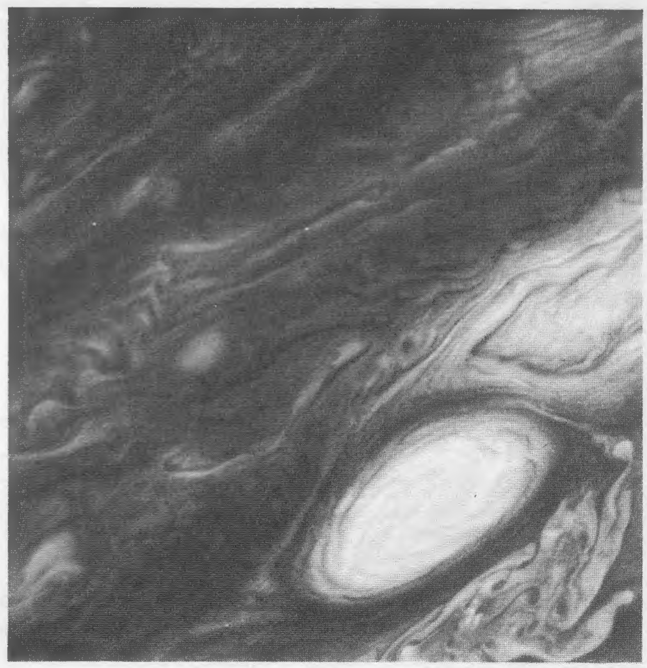

PARTS OF THE PUZZLE – Three white ovals observed to form in the southern hemisphere about 40 years ago have internal structure identical to that of the Great Red Spot first observed by Robert Hooke nearly 315 years ago.

The ovals travel across the planet at a different rate than the Great Red Spot; the white oval seen south of the Red Spot in the above Voyager 2 mosaic is not the same one seen there by Voyager 1 in March 1979. The oval in upper right photo is currently west of the Spot, while the oval in the photo at lower right is currently east of it.

The key to understanding Jupiter's atmospheric dynamics may be wave interactions with the mass flow. The longevity of some features could be due to internal heating. Infrared studies show that the Great Red Spot is cooler than the surrounding clouds.

The Great Red Spot and its three companion white clouds shown here all rotate anticyclonically (counterclockwise in the southern hemisphere), indicating that they are all meteorologically similar. Recirculating currents are seen to the east of all four features.

Since the bulk of Jupiter is comprised of transparent gases – hydrogen and helium – the coloration must come from the chemistry and dynamics of minor atmospheric constituents.

Current theories for the reddish color of the Great Red Spot suppose that phosphine (PH_3), a combination of one phosphorous atom and three hydrogen atoms, is converted by the sun's ultraviolet rays to red phosphorous (P_2 or P_4) when it reaches the top of the cloud.

The white ovals, about 13,000 kilometers (8000 miles) in diameter, are also very cold. They may be high-altitude clouds of ammonia crystals.

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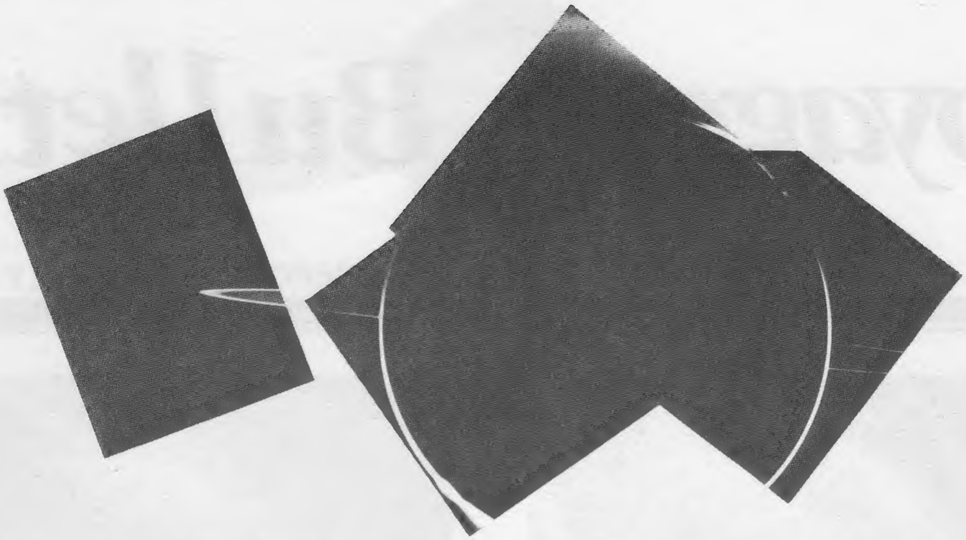


JUPITER'S HALO — From the dark side of Jupiter, backlit by the sun, the thin ring of particles discovered four months ago by Voyager 1 glows like a halo in this four-picture mosaic taken by Voyager 2 on July 10, 1979. Forward scattering of light from the ring's small particles give it its brightness, while the planet is outlined by sunlight scattered from a haze layer high in Jupiter's atmosphere. The ring particles appear to be small, leading to questions on how the ring survives. About 6500 kilometers (4000 miles) wide and four-tenths to eight-tenths kilometer (one-quarter to one-half mile) thick, the ring extends outward to about 53,000 kilometers (33,000 miles) from the top of Jupiter's cloud cover. There is structure within the ring extending all the way to the planet's upper cloud decks. Voyager 2 was about 1.5 kilometers (900,000 miles) beyond the planet when it returned these images to Earth during a search for lightning and auroras on the dark side.

Summary

Although Voyager 2 is three weeks beyond Jupiter and its marvelous satellites, the spacecraft is still very much in the Jovian system and continuing to gather information about the magnetic fields and charged particles on the leeward side of the planet (opposite the sun).

Two trajectory corrections (TCM's) this month, on July 9 and 23, have adjusted Voyager 2's flight path toward Saturn and Uranus. Now flying a route that will take it past Uranus in January, 1986, Voyager 2 will make its closest approach to Saturn about August 26, 1981.

Both of the TCM's were designed to take advantage of Jupiter's gravity to change the spacecraft's velocity and to bend its flight path. The maneuver on July 9 came only hours after closest approach to the planet, during concentrated imaging of Io designed to study volcanic activity on the puffing satellite. This was the first time Voyager had conducted active science measurements during a TCM.

Radiation Effects

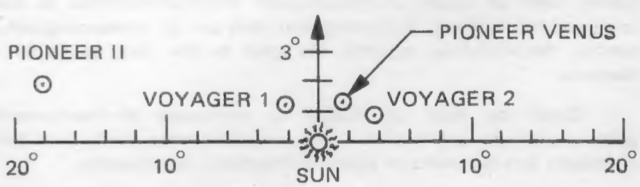
Encountering higher than expected radiation levels as it passed Jupiter, Voyager 2 experienced several problems, some of which are continuing and are still being investigated. The affected systems include the command receiver, the photopolarimeter instrument.

High radiation levels caused some expected problems in transmitting commands to the spacecraft near closest approach to the planet. Due to a failure in April, 1978, the ship's only remaining radio receiver is unable to follow a changing radio signal. Commands must be sent repeatedly, at varying frequencies, until the receiver locks up on the signal. (The signal frequency changes as it travels from Earth to the spacecraft due to the Doppler effect.) In addition, the receiver is sensitive to heating effects such as those caused by high radiation. The command receiver stabilized soon after closest approach and has operated well since.

The photopolarimeter instrument may also have experienced radiation damage. The instrument has three wheels (aperture, filter, and polarization analyzer) designed to give many combinations of observations. The filter wheel appears to be skipping every other position, reducing the number of available filters for observations. The polarization wheel was not operated at Jupiter because of problems earlier in the flight, but appears to have moved several positions from the open position in which it had been left. Color photometry may still be possible.

Solar Conjunction

Voyagers 1 and 2 will participate in high-latitude solar wind observations during August and September as the Earth moves to the opposite side of the sun from the spacecraft. As seen from the Earth, the spacecraft will appear to pass behind and slightly north of the sun, travelling a narrow path approximately one-degree wide.



ALL SPACECRAFT ON AUGUST 20, 1979

VERTICAL SCALE IS TWICE THAT OF HORIZONTAL SCALE

Radio signals from the spacecraft will pass through the northern solar corona, causing strong, measurable changes in the signals. Small-scale variations of plasma in the solar region will be studied, and the plasma density of the solar wind and corona will be mapped.

The Earth and most spacecraft orbit within seven degrees of the sun's equatorial plane. In August and September, a parade of planetary probes including both Voyagers, Pioneer 11, and Pioneer Venus will be aligned to provide multiple, correlating observations.